Chapter IV – Industrial Policies

Option 10: Undertake an Industry Challenge and Recognition Program to Stimulate Industrial Energy Intensity Reductions

Background

Utah's industrial sector is important in terms of energy use and economic impact. As of 2005, the industrial sector (including manufacturing and mining) accounted for 32 percent of electricity use and 34 percent of natural gas use statewide (excluding natural gas use for electricity generation), as well as a notable amount of coal and petroleum usage.[89] Manufacturing and mining contributed $12.2 billion towards the state's total economic output (gross state product) of $91 billion in 2005. Industry is important in terms of employment and income generation in the state, with this sector accounting for about 11 percent of non-farm jobs and 14 percent of non-farm wages.[90]

There is significant potential to increase energy efficiency in industrial facilities. For example, the U.S. Department of Energy estimates it is possible to reduce energy use in the mining industry nationwide by about 50 percent through application of current and emerging technologies.[91] As another indication of significant energy efficiency potential in the industrial sector, the self-direction program implemented by RMP allows for a large energy user to opt-out of paying one-half of its DSM surcharge if the company demonstrates it has no remaining energy efficiency projects with a payback period of eight years or less. So far no industry or large commercial facility in Utah has taken advantage of this option.

Reducing energy usage in industrial facilities will increase productivity and enhance competitiveness, thereby improving businesses profitability and contributing to the state's economic viability and diversity. But there are barriers to greater energy efficiency in industrial facilities. These barriers include: 1) relatively low energy prices paid by industries; 2) lack of priority placed on reducing energy use and costs, especially in companies where energy bills are a small fraction of the total cost of production; 3) lack of trained staff and awareness of energy efficiency measures and technologies; and 4) competition for capital.[92] These factors lead many companies to implement only those energy efficiency projects with a very rapid payback period, on the order of two years or less.

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[89] Energy Information Administration, Utah State Energy Profile, 2007. http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=UT.
[90] Bureau of Economic and Business Research, University of Utah.
[91] "Energy-Efficient Technology for Mining." Presentation by Mike Mosser, National Energy Technology Laboratory at the Utah Mining Association Annual Convention, Aug. 23, 2007.
[92] S.J. DeCanio. 1993. "Barriers within firms to energy-efficient investments." *Energy Policy 21*(9): 906-914. Also, personal communication with Todd Currier, Washington State University Energy Extension Program, March 2007.

A number of state, regional, and national industrial energy efficiency initiatives have removed barriers and resulted in significant energy and cost savings. At the state level, energy agencies in both New York and Wisconsin have implemented effective technical assistance programs for industries in their states.[93] At the regional level, the Washington State University Energy Program provides best practice training for industries throughout the Northwest, along with targeted technical assistance to individual companies.[94]

At the national level, the Canadian Industry Program for Energy Conservation (CIPEC) combines goal-setting and recognition with technical assistance, networking, incentives, audits, and process efficiency studies. CIPEC has been in operation for 30 years, with participation by more than 5,000 industrial firms representing nearly 98 percent of Canada's industrial energy consumption. Greater energy efficiency and improved energy management enabled Canadian industries to reduce their energy intensity 9.1 percent between 1990 and 2004, resulting in $3.1 billion in energy cost savings in 2004 alone.[95] In addition, the Netherlands has implemented a very effective industrial energy efficiency program featuring voluntary energy intensity reduction commitments by companies and sectors, technical assistance, and financial assistance.[96]

Various Fortune 500 companies have made commitments to reduce their energy intensity and have achieved impressive results. DuPont, for example, committed to limit its total energy use through 2010 to no more than that used in 1990, despite considerable growth in production. The company's energy efficiency efforts and process modifications resulted in energy use as of 2002-03 that was 7 percent below the level in 1990, while production increased 30 percent, meaning nearly a 29 percent reduction in energy intensity in 12 to 13 years.[97]

In Utah, Rocky Mountain Power's (RMPs) energy efficiency programs, including its Energy FinAnswer, FinAnswer Express, and Self-Direction programs, have played an important role in stimulating industrial energy efficiency improvements. Industries participating in at least one of these programs in 2006 saved about 41 GWh that year, accounting for 34 percent of the electricity savings achieved by all of RMP's efficiency programs. However, there is no state or utility program promoting more efficient use of natural gas and other fuels in the industrial sector.

Two other state programs have helped businesses in Utah improve energy efficiency and cut energy waste. The Utah Industries of the Future (UIOF) program implemented educational workshops and best practice training courses for industrial energy managers. The Intermountain Industrial Assessment Center (IIAC), administered by the

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[93] A.M. Shipley, R.N. Elliott, and A. Hinge. 2002. *Energy Efficiency Programs for Small and Medium-Sized Industries*. Washington, DC: American Council for an Energy-Efficient Economy.
[94] See http://www.energy.wsu.edu/ for details.
[95] Canadian Industry Program for Energy Conservation, 2007, accessible online: http://oee.nrcan.gc.ca/industrial/cipec.cfm?attr=24, accessed March 2007.
[96] H. Geller. 2003. *Energy Revolution: Policies for a Sustainable Future.* Washington, DC: Island Press, pp. 106-108.
[97] A.J. Hoffman. 2006. *Getting Ahead of the Curve: Corporate Strategies That Address Climate Change.* Arlington, VA: Pew Center on Global Climate Change, p. 91.

University of Utah, provided on-site energy efficiency assessments for small and medium-size industries in Utah, Idaho, and Wyoming. With a budget of $733,000 during 2001-06, the IIAC made recommendations that are expected to result in $9.6 million in annual energy savings with an average simple payback period of 1.4 years, assuming a 50 percent implementation rate on recommended actions.[98] However, due to federal funding cuts, neither the UIOF program nor the IIAC are currently in operation.

Specific Energy Efficiency Proposal

This policy option proposes establishing a Utah Industry Challenge and Recognition Program within the State Energy Program. The Challenge and Recognition Program would include the following elements:

1. Challenge industrial firms operating in Utah to voluntarily establish energy intensity (energy use per unit of output) reduction goals and to commit to implementing cost-effective energy efficiency projects at a higher rate than in the past. In particular, we suggest requiring companies that participate in the program to commit to: a) establishing energy intensity reduction goals, b) auditing all facilities that have not been audited in recent years, say within the past three years, c) implementing all energy efficiency measures and projects with a five year payback or less within say five years, and d) tracking and reporting progress annually. Likewise, the Challenge Program itself should maintain a data base on progress, including energy savings and economic benefits.

2. Implement an annual awards program to recognize and honor industrial firms that are participating in the Challenge program and have made exemplary efforts to reduce energy intensity and achieve significant energy savings. The awards program could be administered by the State Energy Program, with the awards given out by the Governor at an annual awards ceremony.

3. Increase the scope and impact of utility financial and technical assistance programs for the industrial sector. In particular, we urge Questar Gas Company (QGC) to implement natural gas demand side management (DSM) programs for industrial customers, both full service and transportation gas customers (see Option 4 above). These programs can be modeled on successful gas DSM programs for industrial customers in other jurisdictions.[99] In addition, we recommend that RMP expand marketing and promotion of their incentive programs to industrial customers, and that larger municipal utilities initiate such incentives.

[98] Personal communication with M. Krahenbuhl, Director, Nuclear Engineering Program, University of Utah, 2007.

[99] Some gas utilities do implement DSM programs for all customers, not only their full service customers. M. Kushler, D. York and P. Witte. 2003. *Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Programs*. Washington, DC: American Council for an Energy-Efficient Economy. http://aceee.org/utility/ngbestprac/u035.pdf.

4. Expand industrial energy efficiency training and technical assistance activities such as those formerly provided by the UIOF program and the IIAC. State funding should be provided along with co-funding from industry groups, utilities, and/or federal agencies, if such funding can be obtained. Given previous experience with federal grants, state funding is critical for ensuring the stability and continuity of training and technical assistance efforts. Training and technical assistance is especially important for small and medium-size industries.

Energy Savings

Our energy savings analysis is limited to electricity, natural gas, and petroleum products. In reality there should be savings of other fuels such as coal used directly by industry, but it is unclear how much cost-effective energy savings potential exists for coal and other fuels. Electricity, natural gas, and petroleum products represent the large majority of energy consumed by industries in Utah. Regarding natural gas and petroleum products, we restrict our analysis to fuel used for energy purposes; i.e., we exclude natural gas and petroleum used as feedstocks in the chemical and other industries.[100]

Our analysis is based on assumptions regarding average energy intensity reduction over time as the Challenge Program and other activities suggested above are implemented, relative to a baseline industrial energy use scenario. Our baseline assumptions are based on forecasts from RMP and QGC, in particular baseline growth rates of 1.7 percent per year for electricity and 2 percent per year for natural gas. In addition, we assume baseline growth of 1 percent per year for petroleum products consumed by industry. These growth rates are higher than those expected in the industrial sector nationwide,[101] but Utah's population and industrial output (including natural resource extraction) are growing much faster than the national average.

Regarding reductions in energy intensity, we assume that this initiative would reduce industrial energy intensity by 0.25 percent starting in 2008, an additional 0.50 percent in 2009, an additional 0.75 percent in 2010, and an additional 1.0 percent per year in 2011 and thereafter. Our assumption of an incremental annual reduction in energy intensity of 1.0 percent per year once the program ramps up is supported by an in-depth analysis sponsored by the U.S. Department of Energy of the achievable potential for energy intensity reduction in different industrial sectors.[102] These reductions in energy intensity are in addition to those already occurring and expected in the future due to

[100] Estimates of feedstock use provided by Mike Vandenberg, Utah Geological Survey, Salt Lake City, UT, April 2007.
[101] *Annual Energy Outlook 2007*. DOE/EIA-0383(2007). Washington, DC: Energy Information Administration, U.S. Department of Energy. Feb.
[102] Interlaboratory Working Group. 2000. *Scenarios for a Clean Energy Future*. Oak Ridge, TN: Oak Ridge National Laboratory and Berkeley, CA: Lawrence Berkeley National Laboratory. www.ornl.gov/ORNL/Energy_Eff/CEF.htm.

ongoing technological advances, structural shifts, and other policies such as utility energy efficiency programs.[103]

The overall reduction in industrial energy intensity, shown in Table 9, reaches 6.5 percent in 2015 and 11.5 percent in 2020. These percentages are applied to the baseline forecasts of electricity, natural gas, and petroleum product use in order to estimate energy savings. In reality there are likely to be different rates of energy intensity reduction for different forms of energy, but we lack detailed information on industrial energy savings potential that would enable us to make such a differentiation.

Table 9 – Projected Energy Savings from the Utah Industry Challenge and Recognition Program

Year	Percent Reduction in Energy Intensity	Electricity savings (GWh/yr)	Natural Gas Savings (million decatherms/yr)	Petroleum Product Savings (trillion Btu/yr)
2007	0	0	0	0
2008	0.25	21	0.12	0.05
2009	0.75	64	0.38	0.17
2010	**1.50**	**130**	**0.78**	**0.33**
2011	2.50	221	1.32	0.56
2012	3.50	315	1.88	0.80
2013	4.50	411	2.47	1.03
2014	5.50	511	3.08	1.28
2015	**6.50**	**615**	**3.71**	**1.52**
2016	7.50	721	4.37	1.77
2017	8.50	831	5.05	2.03
2018	9.50	945	5.76	2.29
2019	10.50	1,062	6.49	2.56
2020	**11.50**	**1,183**	**7.25**	**2.83**

Cost and Cost Effectiveness

Regarding the cost to the state of Utah, we are suggesting a budget of $400,000 per year for establishing and implementing the Industry Challenge and Recognition Program as well as supporting training and technical assistance activities.[104] We expect

[103] The Energy Information Administration projects that in the absence of new energy efficiency initiatives, the overall energy intensity of the U.S. industrial sector (energy consumption per dollar of shipment) will decline 1.3% per year on average during 2005-2030. See Reference 101.
[104] The State Energy Program does not have the resources or capability to implement a program along these lines at the present time.

that it should be possible to obtain at least $100,000 per year in total co-funding from industry groups, utilities, and federal agencies.

Regarding cost to the private sector, upgrading the energy efficiency and modifying industrial operations in ways that save energy are very cost-effective. For example, energy efficiency and conservation measures recommended by the Industrial Assessment Centers funded by the U.S. Department of Energy during 2000-2005 showed a median benefit-cost ratio of 5.65 and a median simple payback period of just 0.43 years.[105]

For the policy outlined above, we assume that energy efficiency projects implemented by industries in pursuit of their energy intensity reduction targets have a simple payback of three years on average. Some projects will pay back more rapidly; others will have a longer payback period. In addition, we assume that industrial energy efficiency measures and projects have a lifetime of 15 years on average. In aggregate, we estimate that adopting this policy and meeting the energy savings targets will lead to about $145 million in investment in energy efficiency measures during 2006-2015 (discounted net present value). The resulting energy bill savings over the lifetime of these measures would equal about $500 million on a present value basis, meaning a net economic benefit of about $356 million (2006 dollars, net present value). Additional net benefits will result from efficiency measures and projects implemented during 2016-2020.

Environmental and Social Benefits

By reducing the amount of electricity consumed by industries, this option would reduce water consumption by power plants. The estimated total water savings are about 330 million gallons per year by 2015 and 630 million gallons per year by 2020. During 2008-2020, the Program would reduce water consumption in the state by an estimated 4.1 billion gallons.

Table 10 shows the estimated pollutant emissions reductions in 2015 and 2020 from reduced operation of coal and gas-fired power plants, as well as reduced direct natural gas and petroleum use in industries. By cutting air pollutant emissions, the efficiency standards would have a beneficial effect on public health and would help the state meet its air quality goals.

[105] A.M. Shipley and R.N. Elliott. 2006. *Ripe for the Picking: Have We Exhausted the Low-Hanging Fruit in the Industrial Sector?* Washington, DC: American Council for an Energy-Efficient Economy. April.

Table 10 – Estimated Emissions Reductions from the Utah Industry Challenge and Recognition Program

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand metric tons)	710	1,367
SO_2 (short tons)	363	676
NOx (short tons)	673	1,288
Mercury (pounds)	3.6	6.8

Increasing energy efficiency in Utah's industrial sector will provide other environmental and social benefits besides water savings and emissions reductions from reduced energy consumption. Measures such as better control of industrial process equipment or better lighting can result in productivity gains worth more than the energy savings alone.[106] Likewise, technologies such as better combustion control or more efficient burners can reduce NOx and other pollutant emissions at the same time energy savings are achieved, thereby improving air quality and/or reducing environmental compliance costs. For example, new oxy-fuel burners for the glass or steel industries reduce NOx and CO_2 emissions by 90 percent or more, reduce particulate emissions by up to 30 percent, and increase furnace production rates, in addition to cutting energy use substantially compared to traditional burners.[107]

Political and Other Considerations

The proposed Industry Challenge and Recognition program is voluntary, meaning that companies would choose whether or not to participate. It will be necessary to achieve cooperation and participation from industries representing a large fraction of total industrial energy use in order to have the impacts suggested above. Therefore, we recommend consulting with major industries in the state before defining the program in detail, if a decision is made to proceed. The challenge will be to design a program that will stimulate a high level of participation as well as a high level of incremental investment in energy efficiency measures. Identifying champions for the program within the industrial sector will be critical in this regard.

Priority

The industrial sector is an important energy-using sector in Utah, and has been slow to fully embrace energy efficiency. The potential for energy and cost savings in this sector is very significant, with additional macroeconomic and environmental benefits as

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[106] See Reference 20.

[107] E. Levine and K. Jamison. 2001. "Oxy-Fuel Firing for the Glass Industry: An Update on the Impact of this Successful Government-Industry Cooperative Effort." *Proceedings of the 2001 ACEEE Summer Study on Energy Efficiency in Industry.* Washington, DC: American Council for an Energy-Efficient Economy, pp. 375-383.

well. Also, this is the only option targeted directly to the industrial sector. For these reasons, we recommend it be viewed as a **high priority** by the Governor, Legislature, and other stakeholders.

Case Study 5:

Compressed Air Systems:
ATK Launch Systems, Magna / West Valley City

ATK Launch Systems, Inc. is the world's leading manufacturer of rocket motor systems for human-rated and unmanned space launch vehicles, strategic missiles, prompt global strike missiles, and missile defense inceptors. ATK Launch Systems Bacchus Operations has been actively engaged in energy efficiency activities, having implemented more than $12 million in energy saving measures over the past ten years. Systems include SCADA, lighting, building equipment and controls, steam generation and distribution, compressed air generation and distribution, etc.

Recently ATK has focused on compressed air systems. Several projects have been completed, are in progress, or planned over the next few years. An example of a recently completed project is provided below:

<u>Quick Facts</u>

Total Project Cost: $130,000
Annual Energy Savings: 960,000 kWh
Annual Cost Savings: $41,000
Utility Self Direction Credit: $102,000
Measures:
1) Replaced large air compressor with smaller, load tracking compressors, added sequencing systems w/SCADA, dryer controls and other improvements,
2) Optimized system operating pressure,
3) Reduced system compressed air demand.

Benefits:
- Reduced operating costs
- Reduced system peak electrical demand
- Improved reliability
- Upgraded equipment
- Reduced emissions at coal-fired power plants

Source: ATK Launch Systems, 2007

Option 11: Remove Barriers and Provide Incentives to Stimulate Greater Adoption of Combined Heat and Power (CHP) Systems

Background

Most commercial buildings and manufacturing firms purchase electricity for cooling, fans, pumps, equipment, lighting, processes, etc., and buy fuels to generate heat. The electricity is generated at power plants distant from the industrial site at an efficiency of 30 to 40 percent, so most of the energy content of the fuel is wasted as heat to the surrounding environment. Further energy losses occur in the transmission and distribution (T&D) of electricity from the power plants to end users. The Utah energy baseline estimates T&D losses to be 9 percent of power generated in the state. On-site thermal energy is produced at efficiencies in the neighborhood of 70 percent.

Combined heat and power (CHP), or co-generation, is an efficient distributed generation technology that produces both heat and power from a single fuel source. Such systems can have overall efficiencies of 80 percent or better. These systems also provide additional savings associated with reduced T&D losses. One study estimated that the 77,000 MW of installed CHP capacity in the U.S. as of 2003 saved about 2.2 quads (quadrillion Btus) of energy.[108]

As of 2005, Utah had 16 operating CHP facilities with a total installed capacity of 239 MW, according to a recent White Paper prepared for the Western Governors' Association (WGA).[109] Existing CHP systems include a 22 MW facility at the Tesoro refinery in Salt Lake City, a 37.2 MW system at the U.S. Magnesium plant in Rowley, a 16 MW unit at Little Mountain (utility owned) in Ogden, and a 34.4 MW system owned by the City of Springville. Most of the CHP systems in Utah are fueled by natural gas, but some operate using coal, biomass, or waste materials. Systems are owned and operated by end users and utilities, including municipal utilities and Rocky Mountain Power.

In spite of the growth of CHP capacity in recent years, there are still many barriers inhibiting greater use of CHP systems. In Utah as well as many other states, these barriers include the fundamental differences in utility and end user economic perspectives, difficult and costly grid interconnection procedures and power contracting processes, high utility tariffs for standby or backup power, concerns about a potential adverse impact on air quality in non-attainment areas such as Salt Lake County, and lack of financial incentives to stimulate CHP system implementation.

[108] H. Geller, et. al. 2006. "Policies for increasing energy efficiency: Thirty years of experience in OECD countries." *Energy Policy 34*: 556-573.

[109] Combined Heat and Power White Paper. Report prepared for the Clean and Diversified Energy Initiative, Western Governors' Association, Jan. 2006. http://www.westgov.org/wga/initiatives/cdeac/CHP-full.pdf.

Specific Energy Efficiency Proposal

Increasing the penetration of CHP into the energy supply mix in Utah will require addressing barriers and providing incentives and/or market frameworks to offset the logistical and financial challenges associated with installing and operating CHP systems. The proposals below include suggestions which could help address these challenges.

A) Remove Barriers

Current environmental regulations for combustion systems are based on fuel input. A 33-percent efficient central generation power plant (producing 1 kWh of electricity for every 10,500 Btu of fuel consumed) has the same emission limits as an 80-percent efficient CHP plant. We recommend that Utah adopt output-based emissions standards based on the model standards developed by the Regulatory Assistance Project.[110] Such standards have been adopted in other western states, including Texas and California.

Interconnection of small power systems to the distribution grid is a complex process which often creates barriers to installation of CHP and other distributed generation systems. PacifiCorp has been working on interconnection rulemaking in the eastern portion of the system, particularly in Oregon. We recommend that the State of Utah follow the Oregon rulemaking and work with RMP to develop streamlined interconnection procedures as close to those adopted in other states as possible. In addition, we recommend that the Public Service Commission undertake a review of rates, including those for standby or backup power promulgated by RMP as well as non-investor owned utilities in the state, to make sure they are not discriminatory toward CHP systems.

Installing CHP systems in buildings can create challenges for an owner dealing with building code and permitting procedures. We recommend adopting simplified, streamlined, and consistent permitting procedures for CHP systems. We also suggest providing training for local code officials, since these officials are often not familiar with CHP systems. This training can be included in the comprehensive energy efficiency training called for in Option 22.

B) Promote Alternative Fuel and Waste Heat-based CHP Systems

Natural gas has been the fuel of choice for most CHP systems to date, but recent increases in natural gas costs, due in part to the growth in central station gas-fired power plants, have adversely affected the economics of CHP systems. Increasing the use of alternative fuels such as wastewater treatment plant or other digester gases (also known as opportunity fuels) and waste heat-based CHP systems is a way to continue CHP expansion in the face of high natural gas prices.

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[110] *Model Regulations for the Output of Specified Air Emissions from Smaller-Scale Electric Generation Resources*. Gardiner, ME: Regulatory Assistance Project. October 2002. http://www.raponline.org/showpdf.asp?PDF_URL=%22ProjDocs/DREmsRul/Collfile/ReviewDraftModelEmissionsRule.pdf%22.

Specific recommendations to achieve this objective include: 1) provide utility incentives for waste heat-based power generation under utility DSM programs; 2) quantify the opportunity fuel and waste heat resource in the state and identify the most promising CHP opportunities; 3) provide technical assistance to businesses interested in evaluating waste heat and opportunity fuel CHP systems; 4) provide assistance with regulatory and permitting issues; and 5) encourage high efficiency CHP systems as an alternative to biomass-fired heating or stand-alone electric generation.

C) Establish Favorable Market Conditions

A number of steps can be taken to provide reasonable financial incentives and favorable market conditions for expansion of high performance CHP systems, meaning those with an overall efficiency of at least 60 to 70 percent. In particular, we recommend consideration of requiring utilities to pay a large fraction of full avoided costs for power supplied to the grid from high performance CHP systems. These full avoided costs should include avoided generation and T&D costs, not just fuel and operating costs. Full avoided costs are used to justify and set incentives for DSM programs. They should be used for both evaluation of and contract terms with CHP system owners as well.

Second, we recommend encouraging utility ownership or co-ownership of CHP systems, in effect converting the utility from a CHP inhibitor to a CHP proponent. Utilities should be allowed to earn their authorized rate of return on CHP investments at a minimum, and potentially a higher return if a CHP system provides significant net economic benefits for utility customers as a whole. For example, utilities could be allowed a “bonus return” equal to 10-20 percent of the net economic benefits resulting from a CHP project, meaning consumers would receive 80-90 percent of the benefits.

Third, we recommend consideration of tax credits for non-utility owners of CHP systems, with the tax credit based on electricity output similar to renewable energy production tax credits. This policy would bring greater parity between tax treatment of utility-owned power plants and customer-owned CHP and renewable energy systems. Tax incentives are justified since many of the benefits of CHP accrue to society at large rather than to the individual CHP system owner.

<u>Energy Savings</u>

There have been a number of evaluations of CHP or distributed generation potential in recent years. The Combined Heat and Power White Paper prepared for the WGA estimated a potential addition of 1,267 MW of CHP capacity in Utah.[111] However, this is technical potential only. It does not take into account economic or other limitations to CHP adoption.

[111] See Reference 109.

PacifiCorp (RMP's parent company) commissioned a CHP market potential study in 2003.[112] The market assessment was based on information about Utah Power's commercial and industrial customers, including size and load factor, without corresponding information on thermal loads. The study estimated a market potential of between 100 and 150 MW over a five-year period.

The Department of Energy commissioned a review and update of the CHP market potential in the West, looking at several western states including Idaho and Washington but not Utah, in 2005.[113] The study concluded that the CHP potential in the region was much lower than earlier studies, mostly due to the high and volatile price of natural gas. However, the study also concluded that there is significant potential for alternative, "opportunity fuel" based CHP systems.

Table 11 shows our assumptions regarding additional CHP system installation in Utah, assuming a number of the policies suggested above are adopted. We assume it is possible to add a total of 70 MW by 2015 and 115 MW by 2020. This means increasing CHP capacity in the state by about 50 percent, relative to the current level, by 2020.

Table 11 – Energy Impacts of Combined Heat and Power (CHP) Initiative

Year	Incremental CHP Capacity (MW)	Electricity Generation (GWh/yr)	Additional Fuel Consumption (trillion Btu/yr)	Primary Energy Savings (trillion Btu/yr)
2007	0	0	0	0
2008	5	70	0.41	0.39
2009	18	124	0.72	0.70
2010	**28**	**194**	**1.12**	**1.10**
2011	35	248	1.43	1.40
2012	45	318	1.84	1.80
2013	53	371	2.14	2.10
2014	63	441	2.55	2.50
2015	**70**	**495**	**2.86**	**2.78**
2016	80	565	3.27	3.20
2017	88	618	3.58	3.51
2018	98	689	3.98	3.90
2019	105	742	4.29	4.21
2020	**115**	**812**	**4.70**	**4.60**

Table 11 also includes estimates of electricity generation, additional on-site energy consumption, and primary energy savings from the additional CHP capacity each

[112] *Estimation of Market Potential for Combined Heat and Power Applications in PacifiCorp's Utah Service Area.* Report prepared for PacifiCorp by NOVI Energy LLC, April 2003.
[113] *CHP Market Potential in the Western States*. Report B-REP-05-5427-013. Arlington, VA: Energy and Environmental Analysis Inc., September 2005.

year. These CHP systems will most likely operate on some mix of opportunity fuels and natural gas, so we are not able to project how much of which energy sources will be used on-site. In making these estimates, we assume CHP systems have an average capacity factor of 85 percent in the industrial sector and 75 percent in the commercial sector. The estimates also take into account both avoided power generation and avoided T&D losses in response to CHP expansion.

Table 11 shows that if CHP capacity grows as projected, the incremental electricity generation would reach 495 GWh/yr in 2015 and 812 GWh/yr in 2020. The values are equivalent to about 1.4 percent and 2.0 percent of baseline electricity use in 2015 and 2020, respectively. But since the primary energy content of the electricity generation is approximately twice the additional on-site fuel use, the net primary energy savings will reach about 2.8 trillion Btu per year by 2015 and 4.6 trillion Btu per year by 2020. The primary energy savings represent the avoided fuel consumption at central station power plants minus the additional fuel consumption on-site.

Cost and Cost Effectiveness

We estimated CHP installation costs and economic benefits for typical CHP systems used in the commercial and industrial sectors. We assume that these systems will have a simple payback period of 8 years on average in the industrial sector and 7 years on average in the commercial sector (avoided electricity purchases are worth more in the latter). We also assume that CHP systems have an economic lifetime of 25 to 30 years. We ignore any financial incentives in the economic analysis since these are transfer payments from a societal perspective.

In aggregate, we estimate that adding 30 MW of CHP capacity in the commercial sector and 40 MW in the industrial sector by 2015 will cost $69 million but will result in $71 million in net economic benefits (2006 dollars) on a discounted net present value basis. The net economic benefit from the 115 MW of CHP capacity we assume is installed during 2008-2020 is $110 million. Regarding the cost to the state of Utah, we estimate a cost of about $200,000 per year for technical support, assuming no state tax credits are offered. This funding would be used for resource assessments, training, preliminary engineering analyses, and project interconnection and permitting support.

Environmental and Social Benefits

The high energy efficiency of CHP systems, and the displaced central power generation (typically coal-fired generation in Utah), translates directly to environmental benefits, including reduced water consumption and reduced CO_2 emissions. With respect to criteria air pollutants such as sulfur dioxide and nitrogen oxides, the overall impact depends on the difference in emissions rates between the avoided central station power generation and the on-site CHP system. In general the impact is favorable, meaning a net reduction in criteria pollutant emissions.[114]

[114] See Reference 109.

The estimated total water savings from this option are about 215 million gallons per year by 2015 and 354 million gallons per year by 2020. During 2008-2020, adding 115 MW CHP to the energy resource mix would reduce water consumption in the state by an estimated 2.25 billion gallons. The estimated carbon dioxide emissions reduction is about 227,000 metric tons per year by 2015 and 367,000 tons per year by 2020. We do not estimate the net change in criteria pollutants due to uncertainties about CHP system emissions rates.

Political and Other Considerations

CHP installations can provide important public benefits such as alleviating transmission and distribution constraints, energy savings, and emission reductions. But limited experience with CHP technologies as well as multiple regulatory and permitting barriers has slowed the adoption of CHP systems in Utah. In general, industrial and commercial consumers support removal of these barriers, while electric utilities tend to be less supportive. Encouraging utilities to own or co-own CHP systems, and allowing them to keep a small portion of the net economic benefits, could help to overcome the interconnection and tariff-related barriers.

Priority

Overcoming the multiple barriers to more widespread adoption of CHP systems will not be easy. Also, CHP expansion along the lines we suggest would provide moderate energy and economic benefits. For these reasons, we recommend that this option be viewed by the Governor, Legislature, and PSC as a **medium priority**.

Case Study 6:

Combined Heat and Power: Tesoro Petroleum Refinery, Salt Lake City

Tesoro Petroleum Corporation, a Fortune 500 Company, is an independent refiner and marketer of petroleum products. Their 55,000-barrel per day Salt Lake refinery serves the growing gasoline, diesel fuel, and propane needs of the Intermountain West.

Tesoro’s modern combined heat and power (CHP) system facility, installed in 2004, uses two gas turbine generator units and two heat recovery steam generators. The refinery is able to operate on the power and steam produced by the 22 MW CHP system, with excess electricity that is sold to the utility grid. The CHP system operates 24 hours per day, 7 days per week.

Quick Facts

Equipment: 2 Solar Titan Turbines and 2 Rentech Heat Recovery Steam Generators
Fuel: Natural gas and refinery fuel gas
Total project cost: $25 million
Annual energy bills savings and electricity sales revenue: $6 million
Simple payback period: 4.2 years
Benefits:

- Reduced operating costs
- More reliable power
- Upgraded equipment
- Greenhouse gas emissions reductions